CONSTRUCTION SPECIFICATION FOR CONCRETE SIDEWALK AND CONCRETE RAISED MEDIAN

INDEX

TS 3.70.01 SCOPE

This Specification covers the requirements for the construction of plain or reinforced concrete sidewalks and concrete raised medians.

TS 3.70.02 REFERENCES

This Specification refers to the following specifications and publications:

Ontario Provincial Standards

OPSS 180 – Management and Disposal of Excess Material
OPSS 919 – Formwork and Falsework

City of Toronto Standard Specifications

TS 310 – Construction Specification for Hot Mixed, Hot Laid, Asphaltic Concrete Paving
TS 3.50 – Construction Specification for Concrete Curb and Concrete Curb and Gutter
TS 3.80 – Construction Specification for Interlocking Pavers
TS 3.85 – Construction Specification for Impressed Concrete Feature Strip
TS 4.50 – Construction Specification for Utility Adjustments
TS 501 – Amendments to OPSS 501 – Construction Specification for Compacting
TS 1010 – Amendments to OPSS 1010 – Material Specification for Aggregates – Granular A, B, M and select Subgrade Material
TS 1350 – Amendments to OPSS 1350 – Material Specification for Concrete – Material and Production

City of Toronto Standard Drawings

T-310.010-2 – Concrete Sidewalk with Boulevard
T-310.010-3 – Cncrete Sidewalk with Retaining Curb
T-310.010-4 – Combined Concrete Curb and Sidewalk
T-310.020 – Curb Cut and Sidewalk Ramp at Intersections

Canadian Standards Association (CSA)

CSA A23.1 – Concrete Materials and Methods of Concrete Construction

TS 3.70.03 DEFINITIONS

Base Course: means a layer of specified or selected materials of planned thickness constructed on the subgrade for drainage and to distribute pavement loads.

Contraction Joint: means a cut or formed joint to regulate the location and degree of cracking in the plane of the pavement.

Expansion Joint: means a physical separation between the concrete and appurtenances, or between parts of the sidewalk or raised median, which allows both horizontal and vertical movement.

Slipform: means the placing, consolidating and extruding of plastic concrete in a machine without the use of fixed side forms.

Subgrade: means the soil prepared and compacted to support a structure or pavement.

TS 3.70.04 SUBMISSION AND DESIGN REQUIREMENTS

TS 3.70.04.01 General

Any required submissions shall be in writing. All submissions shall be submitted to the City at least three weeks prior to the beginning of the work.

The requirements for submissions and design requirements are given in TS 1350.

TS 3.70.04.02 Materials

Prior to starting the work, the Contractor shall supply the City with material safety data sheets (MSDS) for all the materials to be incorporated in the work.

The Contractor shall be responsible for selecting the concrete materials and for the mix design for the concrete. The concrete mix proportions shall meet the requirements of CSA A23.1 and this Specification.

The certificate of ready mix facilities and/or the certificate of mobile mix concrete production facilities along with the City of Toronto Form A or B (concrete mix details) shall be submitted as required by Specification TS 1350.

Details of the method of curing and curing materials (including manufacturers' literature, where applicable) shall be submitted to the City.

One copy of the concrete delivery ticket shall be submitted to the City for each load of concrete delivered.

TS 3.70.05 MATERIALS

TS 3.70.05.01 Supply of Materials

Unless otherwise specified in the Contract, the Contractor shall supply all materials necessary for the execution and completion of the work.

TS 3.70.05.02 Concrete

The materials for and the production of concrete sidewalks shall meet the requirements of TS 1350 and the following:

1)	Cement type	Normal Portland GU
2)	Minimum 28 day compressive strength	32 MPa
3)	Class of exposure	C-2
4)	Maximum nominal size of coarse aggregate	19 mm
5)	Slump at point of discharge	80 ± 30 mm
6)	Air content	6.5 ± 1.5%
7)	Maximum water/cementing materials ratio	0.45

TS 3.70.05.03 Granular Base and Backfill

Granular base and backfill, if required, shall be Granular 'A' and shall meet the requirements of OPSS 1010.

TS 3.70.05.04 Welded Steel Wire Fabric

Welded steel wire fabric shall meet the requirements of TS 1350.

Unless otherwise specified, all welded steel wire fabric detailed on the plans or ordered by the City for incorporation in the concrete sidewalk or raised median shall be 152 x 152 - MW 13.3 x MW 13.3 welded steel wire fabric @ 1.46 kg/m^2.

TS 3.70.05.05 Expansion Joint Material

Expansion joint material shall be bituminous fibreboard having a minimum thickness of 12 mm and shall meet the requirements of TS 1350.

TS 3.70.06 EQUIPMENT

TS 3.70.06.01 Forms

Forms shall be steel, wood or metal plate forms and shall meet the requirements of OPSS 919. They shall be of sufficient cross section and strength, and so secured as to resist the pressure of the concrete when placed, and the impact and vibration of any construction equipment they support, without springing or settlement.

Forms shall be pinned or staked in place with not less than 3 pins for each 3 m length, and with a pin at each side of each form butt joint. The top surface of the formwork shall comply with the specified tolerances. The inside face of the form shall be vertical. The form shall deviate from grade by no more than 3 mm in 3 m, and in alignment by no more than 6 mm in 3 m.

Forms shall be cleaned and coated with form oil before each use.

TS 3.70.06.02 Slipforming Equipment

The equipment shall be designed for slipforming concrete sidewalks and shall have automatic horizontal and vertical controls to be used in conjunction with at least one stringline.

TS 3.70.06.03 Finishing Tools

An aluminum or magnesium float shall be used to float the concrete sidewalk and a small radius edger shall be used to tool the edges.

TS 3.70.07 CONSTRUCTION

Prior to starting the work, the Contractor shall submit the verification that either the foreman/lead hand or the supervisor of the placing crew has ACI Flatwork Certification.

TS 3.70.07.01 Excavation

TS 3.70.07.01.01 General

Excavated material shall be removed from the site and disposed of in accordance with OPSS 180, at the Contractor's expense.

TS 3.70.07.01.02 Sidewalk

The excavation for the sidewalk shall be to the lines and grades specified by the City. Care shall be taken to prevent damage to utilities, window openings, areaways, and other appurtenances such as hydrants, water services, poles and gas valves which may be in or under the proposed sidewalk.

At the direction of the City, the Contractor shall make good all damage caused during the course of the work and return the work to its initial condition. This shall be at the Contractor’s expense.

TS 3.70.07.01.03 Concrete Raised Median

Where a raised median is to be placed on an existing pavement, the existing asphalt shall be removed down to the concrete base in the case of a composite pavement, or in the case of a flexible pavement, the asphalt shall be removed to a minimum depth of 75 mm. The existing asphalt shall be removed to form a straight vertical face by saw cutting to the required depth and to a sufficient offset to accommodate framework, but shall not exceed 150 mm from the face of the curb, gutter or median. The asphalt shall be completely removed to the required depth and all loose material swept from the area over which the raised median is to be constructed.

Where a raised median is to be placed, other than as described above, the requirements of the specifications for the individual components shall be used. The individual specifications shall include, but not be limited to TS 3.50, 3.80 and 3.85 for concrete curb and concrete curb and gutter, interlocking pavers and impressed concrete feature strip.

TS 3.70.07.02 Subgrade

The subgrade shall be compacted to a minimum of 95 percent of the maximum dry density as determined by TS 501.

TS 3.70.07.03 Granular Base

The granular base shall be placed to the required lines and grades. Unless specified in the contract, the compacted depth of granular base shall be 150 mm or as directed by the City. The moisture content and compaction of the granular base shall be uniform and shall meet the requirements of TS 1010.

The granular base shall be moistened prior to the placement of concrete, but without any standing water. At the time of placing concrete, the base shall not be wet, soft or frozen.

In areas of underground utilities, polyethylene film (100 μm thick) shall be placed on the base, as directed by the City.

TS 3.70.07.04 Form Placement

Forms shall be set true to the lines and grades specified in the contract and in direct contact with the base.

Unless specified in the contract, the crossfall of the sidewalk or raised median shall be at a slope of 2 percent toward the gutter. When the optimum slope cannot be achieved, the City may instruct the Contractor to adjust the slope to a maximum of 4%.

TS 3.70.07.05 Utility Adjustment

All utility adjustments shall meet the requirements of TS 4.50, except that no boxouts will be required. The top portion of the frame shall be encased with 12 mm expansion joint material, placed flush with the surface of the concrete and the frame and cover. The fibre shall be vertical and straight in alignment.

TS 3.70.07.06 Utility Isolation

Utility isolations shall be constructed in the concrete sidewalk as shown on drawing T-310.010-4, at the locations specified in the Contract or as directed by the City.

TS 3.70.07.07 Reinforcement

Welded steel wire fabric reinforcement, if necessary, shall be placed in the concrete sidewalk and concrete raised median to the details and location specified in the Contract or as directed by the City.

TS 3.70.07.08 Placing Concrete

Concrete shall be placed and consolidated to meet the requirements of CSA A23.1 and the requirements of this Specification. The concrete delivery and spreading operations shall be coordinated so as to provide a uniform rate of progress for the placing operation. Where concrete placing is interrupted for more than 45 minutes, a 12 mm thick bituminous fibre joint filler shall be placed vertically across the sidewalk width, to form an expansion joint, before resuming concrete placement.

The concrete shall be placed to the specified thickness, line and grade. The concrete shall be thoroughly consolidated by the use of 50 mm vibrators and other suitable tools to eliminate voids, honeycombing and entrapped air.

TS 3.70.07.09 Finishing Concrete

The concrete surface shall be finished while it is sufficiently plastic to achieve the desired grades, elevations and texture, with no water on the surface. The surface shall be uniform, dense and free from undulations and projections apart from those specified in the drawings.

The top surface shall be screeded to true grade and cross-section and finished with a magnesium or aluminum float. The final finish shall have a light broom or swirl float texture.

The application of water, neat cement or sand to the surface shall not be permitted. Localized surface imperfections shall be dug out and repaired with fresh concrete before the concrete has set.

Sidewalks on grades of more than 5 percent shall be broom finished transversely to the slope of the sidewalk.

The concrete adjacent to all formwork and joints shall be finished with a tool that produces a 5 mm rounded edge and a smooth, horizontal surface with a maximum width of 50 mm. All tooling shall be uniform and straight and shall be depressed no more than 1 mm below the adjacent surface. Any ridges along the tooled marks shall be removed.

The surface of the concrete sidewalk shall not have irregularities exceeding 6 mm when checked with a 3 m straight edge placed in any direction.

TS 3.70.07.10 Identification Stamp

The Contractor shall mark with an approved stamp at each end of the work, at each tenth bay, and all others places directed by the City. The stamp shall be located on the centre of the bay parallel to a transverse joint.

The stamp shall identify the Contractor's name and the year of construction.

TS 3.70.07.11 Joints

TS 3.70.07.11.01 General

All concrete sidewalk joints shall conform to Standard Drawings T-310.01-3 and T-310.010-4, or as specified in the contract.

All joints shall match the type and location of the adjacent concrete curb, curb and gutter or the concrete road base.

TS 3.70.07.11.02 Contraction Joints

Contraction joints shall be placed transversely as shown on drawing T-310.010-2. Contraction joints shall also be placed longitudinally (parallel to the curb) and 1.5 m from the curb when the slab is 3 m or more in width. The depth of the contraction joint shall be one quarter the concrete thickness.

The maximum distance between joints, in the raised median, shall be 2 metres.

Contraction joints shall be saw cut as specified.

TS 3.70.07.11.03 Expansion Joints

Expansion joints shall be constructed to the full thickness of the sidewalk or raised median and shall be a maximum of 6 metres apart.

Expansion joints shall be filled with 12 mm wide bituminous fibre expansion joint material. The top surface of the bituminous fibre shall be flush with the concrete surface. The fibre shall be vertical and straight in alignment.

Full depth (isolation) joints shall be formed where the concrete abuts buildings and rigid structures, changes direction, encounters appurtenances and shall be constructed as shown on the drawing T-310.010-4. If the face of the structure is rough or irregular, preventing a tight seal, the joint shall be placed 150 mm to 300 mm from the structure.

TS 3.70.07.11.04 Construction Joints

At the end of each day's work, or in the event of an unavoidable stoppage of concrete placement extending more than 30 minutes, an expansion joint shall be constructed at the planned location of a joint. Any excess concrete is to be removed and disposed of, off the site in accordance with OPSS 180.

TS 3.70.07.12 Concrete Curing

Concrete curing shall meet the requirements of TS 1350.

TS 3.70.07.12.01 Curing with Burlap and Water

Burlap mats shall be pre-soaked by immersion in water for at least 6 hours immediately prior to placing. The mats shall cover the entire width and edges of the exposed concrete. The mats shall overlap 300 mm and shall be held down to prevent displacement. The mats shall be maintained in place and kept saturated for a minimum period of 7 days. The Contractor may constantly water the mats or cover them with opaque polyethylene film, or a combination of both, in order to keep the mats saturated.

Alternatively, this method shall be used for a minimum period of 3 days following which the surface shall be cured with curing compound as specified in TS 1350.

TS 3.70.07.12.02 Curing with Geotextile Fabric and Water

Geotextile fabric shall be pre-soaked by immersion in water for at least 6 hours immediately prior to placing. Two layers of fabric shall be applied to the surface of the concrete and shall cover the entire width and edges of the exposed concrete. Strips shall overlap 100 mm and shall be held down to prevent displacement. The fabric shall be maintained in place and kept saturated for a minimum period of 7 days.

The Contractor may constantly water the mats or cover them with opaque polyethylene film, or a combination of both, in order to keep the mats saturated.

Alternatively, this method shall be used for a minimum period of 3 days following which the surface shall be cured with curing compound as specified in TS 1350.

TS 3.70.07.12.03 Curing with Polyethylene Film

White, opaque polyethylene film (100 μm thick) shall be placed such that air flow between it and the concrete surface is prevented. The film shall be held down at the edges and laps, and shall be overlapped a minimum of 150 mm, to prevent displacement. The film shall be kept in place for a minimum period of 7 days.

Alternatively, this method shall be used for a minimum period of 3 days following which the surface shall be cured with curing compound as specified in TS 1350.

TS 3.70.07.12.04 Curing with Membrane Compound

Immediately prior to application, the curing compound shall be agitated by mechanical means to provide a homogeneous mixture. Curing compound shall be spray applied in two coats to the concrete surface, with the second coat applied at right angle to the first coat, such that the membrane formed is uniform in thickness and colour and is free of breaks and pinholes. The surface shall be maintained in this condition for a minimum period of 7 days. The rate of application shall not be less than that specified by the manufacturer of the compound.

TS 3.70.07.13 Concrete Protection

Concrete protection shall meet the requirements of TS 1350.

TS 3.70.07.14 Headers

Where directed by the City, wooden headers, 40 mm thick and 160 mm deep shall be placed at all unpaved entrances or driveways. They shall be held in place by 40 mm x 80 mm stakes driven into the ground at least 700 mm at 1.0 m centres and with the tops flush with the surface of the sidewalk.

TS 3.70.07.15 Ramps

Sidewalk accessibility ramps conforming to drawing TS 310.020 shall be incorporated at each corner radius.

TS 3.70.07.16 Restoration of Asphalt

The additional asphalt removed for framework is to be restored in accordance with TS 310. The asphalt shall be placed in lifts not to exceed 50 mm in depth after compaction.

TS 3.70.08 QUALITY ASSURANCE

Quality assurance shall meet the requirements of TS 1350.

TS 3.40.08.01 Concrete Thickness

The thickness of the concrete structure shall be determined by field measurement or in accordance with a thickness measurement method specified in Contract.

The Contract Administrator reserves the right to verify the thickness of the concrete structure for structural integrity check and payment purpose using a non-destructive testing method or by coring.

When a measurement of concrete thickness is carried out by coring, the measurement shall be based on either a 100 mm or 150 mm diameter core. The diameter of the core shall be at least 3 times the size of the maximum coarse aggregate as per CSA A23.1.

No core shall be taken within 250 mm from the joints or edges. The length of each core shall be determined in accordance with ASTM C 174. Core samples that are broken or obviously damaged shall not be used for concrete thickness determination. The damaged cores shall be replaced by acceptable cores taken from the same sublot(s). Core samples taken for concrete thickness determination shall not be used for compressive strength test.

Regardless of the method used, concrete thickness shall be determined on a lot basis. Each lot shall have 4 sublots of equal size, where each sublot is represented by a thickness measurement. The Contract Administrator will determine the size of the lot(s) and sublots for the purpose of concrete thickness acceptance and payment.

The concrete thickness for a sidewalk and raised median in a lot shall be the average concrete thickness of the lot (Tx). The average concrete thickness for a lot shall be calculated from the following formula:

$$Tx = \frac{T1 + T2 + T3 + T4}{4}$$

Where: Tx is the average concrete thickness for a lot, rounded off to the nearest mm.
T1, T2, T3 and T4 are the concrete thickness for Sublots 1, 2, 3 and 4.

For the purpose of the calculation, any individual sublot measurement that is more than 5 % above the specified thickness shall be assumed to be equal to the specified thickness plus 5 %.

A lot will be accepted, on a thickness basis, if the average concrete thickness of the lot equals or exceeds 100 percent of the specified thickness. Payment for the lot will be determined in accordance with TS 3.70.10.

At the sole discretion of the Contract Administrator, a lot may be accepted and allowed to remain in place, if the average concrete thickness of the lot is between 95 and 100 percent of the specified thickness. The lot accepted based on the above conditions will not be eligible for full payment. Payment for the lot will be determined in accordance with TS 3.70.10. Adjustment of the contract price for the lot shall be based on Table 1.

If the concrete thickness of an individual sublot is less than 95 percent of the specified thickness, the Contractor shall remove and replace the sublot at their expense even if the average concrete thickness of a lot is more than 95 percent of the specified thickness.

All replacement lots shall be accepted on the same basis as the original lot.

TS 3.70.09 MEASUREMENT FOR PAYMENT

TS 3.70.09.01 Concrete Sidewalk
Concrete Raised Median

Measurement will be the surface area of concrete sidewalk and raised median placed in square metres, without any deduction for maintenance holes and appurtenances.

TS 3.70.10 BASIS FOR PAYMENT

TS 3.70.10.01 Concrete Sidewalk - Item

Payment at the contract price for the above item shall be full compensation for all labour, equipment, materials and incidentals to do the work. Payment shall include, but not be limited to, the supplying and placing of the formwork, the supplying, placing, consolidating and finishing of the concrete and the curing and protection of the concrete sidewalk.

At the discretion of the Contract Administrator, payment for the item may be adjusted in accordance with TS 3.70.08.01 and Table 1.

The cost of thickness testing shall be borne by the City unless the results indicate a thickness deficiency of 5 percent or more, in which case the Contractor shall bear all costs of testing.

TS 3.70.10.02 Concrete Raised Median - Item

Payment at the contract price for the above item shall be full compensation for all labour, equipment, materials and incidentals to do the work. Payment shall include, but not be limited to, the removal and disposal of the asphalt and granular material, the supplying and placing of the formwork, the supplying, placing, consolidating and finishing of the concrete and the curing and protection of the concrete raised median.

At the discretion of the Contract Administrator, payment for the item may be adjusted in accordance with TS 3.70.08.01 and Table 1.

The cost of thickness testing shall be borne by the City unless the results indicate a thickness deficiency of 5 percent or more, in which case the Contractor shall bear all costs of testing.

TABLE 1

Thickness Tx	Percent Payment
100 percent of specified thickness or above	100
100 percent of specified thickness to 95 percent of specified thickness	$\frac{(Actual\,Thickness)^2}{(Specified\,Thickness)^2} \times 100$
less than 95 percent of specified thickness	remove and replace at the Contractor's expense